

# **METHODS AND APPARATUS FOR ADAPTIVE PCM LEVEL ESTIMATION AND CONSTELLATION TRAINING**

Inventors: Xuming Zhang  
Sverrir Olafsson

5

## **ABSTRACT**

10 Systems compensate for the presence of digital impairments using adaptive  
constellation techniques. Sample magnitudes are estimated from received samples  
transmitted during a training period using an algorithm based on minimizing the sum of  
squares of the estimated errors, afterwhich a suitable constellation is derived. In one  
embodiment, an optimum least-squares algorithm is employed. In an alternate  
embodiment, a least mean squares (LMS) or normalized LMS algorithm is performed.